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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

SONG, MATTHEW J

ART UNIT PAPER NUMBER

1765

DATE MAILED: 09/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/678,766

Applicant(s)

TOIS ET AL.

Examiner

Matthew J Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-33 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☒ Certified copies of the priority documents have been received in Application No. 10/148525.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/9/2004.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: ____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-4, 8-9, 11-12, 14-17, 21-27, and 31-33 are rejected under 35 U.S.C. 102(e) as being anticipated by Gates et al (US 6,203,613).

Gates et al discloses a method for forming a multicomponent metal oxide film on a substrate by atomic layer deposition comprising subjecting a substrate to a sequence of alternating pulses of four or more different gases (claim 36). Gates et al also discloses using Si precursors, metal precursors and metal halide precursors (claim 37 and 40-41). Gates et al also discloses a process of contacting surface with a Si precursor to bond silicon to the substrate and a co-reactant of water to deposit SiO₂ followed by contacting the surface with Hf(NO₃)₄ to bond the metal to the substrate and water to deposit HfO₂ in an ALD process. Gates et al also teaches purging between each pulse of reactant (col 9, ln 50 to col 10, ln 25). Gates et al also teaches preferred multicomponent metal oxides are silicon containing oxides including hafnium silicate, zirconium silicate, aluminosilicates including rare earth doped silicates (col 9, ln 35-50).

Referring to claims 2 and 25, Gates et al discloses the cycle of reactant gases and purge gases is repeated until a desired thickness is obtained (col 10, ln 1-25 and col 7, ln 25-30).

Referring to claims 3 and 26, Gates et al discloses an oxidizing agent of water, oxygen, ozone and hydrogen peroxide (claim 39).

Referring to claims 4 and 27, Gates et al discloses a metal halide (claim 41).

Referring to claims 8-9 and 32-33, Gates et al discloses a temperature range of 200-400°C (col 7, ln 1-10).

Referring to claims 11-12, Gates et al discloses deposition on a Si wafer having a shallow trench isolation, this reads on applicants' grooved flat material (col 7, ln 45-60).

Referring to claim 14-15, Gates et al discloses depositing a metal oxide.

Referring to claim 16-17, Gates et al discloses depositing the multicomponent oxide film on a silicon substrate to form a gate dielectric (col 9, ln 50-60 and col 4, ln 20-35).

Referring to claim 18, Gates et al discloses the ALD layer can be used as gate dielectrics in field effect transistor (col 4, ln 20-35), this reads on applicant's interlayer in a transistor gate oxide.

Referring to claims 21, Gates et al discloses a separate oxidation step following each contacting step (col 10, ln 1-25).

Referring to claims 22 and 31, Gates et al discloses a silicon vapor precursor reacts with a substrate, an oxygen source converts the silicon compound to oxide, pulsing a metal compound which bonds to the substrate, an oxygen source converts the metal compound to an oxide and an inert purge between each step (col 10, ln 1-25).

Referring to claim 23, Gates et al discloses using water for both oxidizers (col 10, ln 1-10).

Referring to claim 24, Gates et al discloses using the deposition of a gate dielectric consisting of a SiO₂ and a metal oxide (col 9, ln 50-67).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-9, 11-12, 14-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gates et al (US 6,203,613) as applied to claims 1-4, 8-9, 11-12, 14-17, 21-27, and 31-33 above, and further in view of Kang et al (GB 2332980).

Gates et al discloses all of the limitations of claim 5, as discussed previously, except the metal compound is hafnium tetrachloride, or a silicon halide of silicon tetrachloride, hexachlorodisilane or hexachlorodisiloxane.

In a method of atomic layer deposition (pg 1, ln 1-7), Kang et al teaches HfCl_4 gas may be used as a metal halide gas (pg 4, ln 5-22) and SiCl_4 (pg 6, ln 5-15) may be used a silicon containing precursor.

Gates et al discloses using metal halide precursors claim 40), but is silent to the specific precursors claimed. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Gates et al by using the well known metal halide precursors used in atomic layer deposition processes taught by Kang et al because selection of a known material based on its suitability for its intended purpose is held to be obvious (MPEP 2144.07).

Referring to claims 8-9, the combination of Gates et al and Kang et al teaches deposition temperature of 200-400°C. The combination of Gates et al and Kang et al does not teach the exact temperature range claimed. Temperature is well known in the art to be a result effective variable. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Gates et al and Kang et al optimizing the temperature to obtain the claimed range by conducting routine experimentation of a result effective variable (MPEP 2144.05).

Referring to claim 19-20, the combination of Gates et al and Kang et al is silent to the ratio of steps is 1:10 to 10:1 or 1:1. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Gates et al and Kang et al to obtain the claimed ratio by conducting routine experimentation of a result effective variable to obtain a desired composition. Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

5. Claims 8-9, 19-20 and 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gates et al (US 6,203,613).

Gates teaches all of the limitations of claim 8, as discussed previously, except the exact temperature range claimed.

Gates et al teaches deposition temperature of 200-400°C, which overlap the claimed ranges. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify select any temperature disclosed by Gates including applicants overlapping range because overlapping ranges are held to be obvious (MPEP 2144.05). See *In Re Wertheim*, 541 f.2d 257, 191 USPQ 90 (CCPA 1976).

Referring to claim 19-20, Gates et al is silent to the ratio of steps is 1:10 to 10:1 or 1:1. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify to select any proportion of composition ratios that would produce a desired film including the broad range of proportions claimed by applicants because the Gates reference does not restrict the proportion of components. In the absence of unexpected results, any desired amount would have been obvious.

6. Claims 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gates et al (US 6,203,613) as applied to claims 1 above, and further in view of Lowrey et al (US 5,891,744).

Gates et al teaches all of the limitations of claim 10, as discussed previously, except the thin multicomponent oxide is formed on a hemispherical grain structure.

In a monitoring effects of hemispherical grains, Lowrey et al teaches the capacitance of polysilicon layer can be increased by increasing surface roughness of the polysilicon film and one type of polysilicon film which maximizes a roughness outer surface area is hemispherical grain polysilicon (col 1, ln 10-67). Lowrey et al also teaches deposition of a dielectric 16 on a hemispherical grain area, which forms a capacitor (col 4, ln 1-15).

Gates et al teaches a method of depositing a multicomponent oxide dielectric layer for use as a capacitor dielectric (col 3, ln 20-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Gates et al by depositing the oxide layer on a substrate having a hemispherical grain structure, as taught by Lowrey et al, to enhance the capacitance of the capacitor ('744 col 1, ln 45 to col 2, ln 5).

7. Claim 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gates et al (US 6,203,613) as applied to claim 1 above, and further in view of Hong et al (US 5,536,673).

Gates et al teaches all of the limitations of claim 13, as discussed previously, except the substrate is a bottom electrode of a dynamic random access memory (DRAM) capacitor.

In a method of making a dynamic random access memory cell, Hong et al teaches an array of DRAM cells is completed by forming a capacitor dielectric layer on the surface of the bottom electrode (col 3, ln 20-55).

Gates et al teaches a method of forming metal oxides for use as capacitor dielectric and capacitors in DRAM circuits (col 3, ln 20-30 and col 4, ln 20-35). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Gates et al by forming the metal oxide on the bottom electrode to form a DRAM cell, as taught by Hong et

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al, because it conventional known in the art to form a dielectric on a bottom electrode to form a DRAM circuit.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kim et al (US 6,207,487) teaches a method of forming SiO₂ and other dielectrics using ALD (col 8-10).

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song

Application/Control Number: 10/678,766

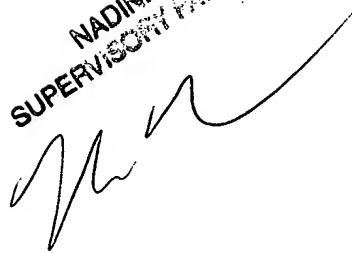
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MJS

NADINE A. NORTON
SUPERVISORY PATENT EXAMINER

A handwritten signature in black ink, appearing to be 'Norton', written over the printed name and title.